with two chambers at each end, that they may be converted with little difficulty to producer-gas firing.

Those furnaces in which only the air is preheated have a slight advantage over those in which both the gas and the air are preheated, in that no unburned gas has to be wasted up the stack at reversal. The amount of fuel lost in this manner depends upon the gas-filled volume between the reversing valve and the port, and the frequency of reversal. When the gas is preheated this loss cannot be avoided.

This gas likewise creates an explosion hazard; when the conditions are right, it burns and passes up the stack as a puff of flame. Again it may become mixed with air, the mixture being below the ignition temperature; when a portion of this mixture is suddenly ignited an explosion of more or less violence occurs. These explosions damage the walls of regenerative chambers, flues and waste-heat boilers so that large amounts of air are drawn into the system, reducing the stack draft and the output of the boiler by reason of the lowering of the temperature of the waste gases.

One of the factors in regard to valve area that meets with little consideration is the velocity of the gases passing through the valve. In addition, most valves involve a change in direction of flow, totaling 360°, 180° in the valve and two 90° changes in the flues. When a stream of flowing gases passes through passages involving changes in area, velocity changes are involved. The velocity of flow in the normal section of the flue may be represented by Fmin and in the contracted area of the valve by Fmax. The corresponding velocity heads will be $A_m$in and Amax- That is, a velocity head = Amax—Amin will be required to produce the increase in velocity. The pressure, in kilograms per square meter or in millimeters of water, required to produce the

increase in velocity will be

$$\delta = (ftmax - hmln) A^*,$$

in which d = pressure in kilograms per square meter or millimeters of water;

Aj=the weight of 1 cu m of the gas in motion at a temperature of $t°$.

When the pressure is desired in inches of water, the weight of the gas being in pounds per cubic foot, the formula is

$$5 = 0.192(ftmax-\sim Amln)\ At^*$$